

Claims:

1. A motor control apparatus that controls a motor,
which is mounted on a vehicle and outputs power to a drive
5 shaft linked to drive wheels, said motor control apparatus
comprising:

an angular acceleration measurement module that
measures an angular acceleration of either the drive shaft
or a rotating shaft of said motor;

10 a skid detection module that detects occurrence of
a skid due to wheelspin of the drive wheels, in response
to an increase in measured angular acceleration over a
preset value;

a first torque restriction control module that, in
15 response to detection of the occurrence of a skid by said
skid detection module, sets a certain torque restriction
rate to restrict an output torque level for reduction of
the skid and controls said motor with the restricted output
torque level; and

20 a torque restoration control module that restores
the output torque level restricted by said first torque
restriction control module and controls said motor with
the restored output torque level at a predetermined timing

when the angular acceleration measured by said angular acceleration measurement module has an increase in the course of convergence of the skid.

5 2. A motor control apparatus in accordance with claim 1, wherein the predetermined timing represents a change timing of the measured angular acceleration from negative to positive.

10 3. A motor control apparatus in accordance with either one of claims 1 and 2, wherein said torque restoration control module controls said motor with a lower torque restriction rate than the certain torque restriction rate set by said first torque restriction
15 control module for a preset time period, so as to restore the restricted output torque level.

 4. A motor control apparatus in accordance with any one of claims 1 through 3, said motor control apparatus
20 further comprising:

 a second torque restriction control module that controls said motor with setting of a specified torque restriction, when an absolute value of a first negative

peak of the measured angular acceleration detected after the increase over the preset value is greater than a predetermined threshold value.

5 5. A motor control apparatus in accordance with claim 4, wherein said second torque restriction control module controls said motor with a torque restriction rate set corresponding to the absolute value of the first negative peak as the specified torque restriction.

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 6. A motor control apparatus in accordance with either one of claims 4 and 5, wherein said second torque restriction control module controls said motor with the setting of the specified torque restriction for a
15 predetermined time period.

 7. A motor control apparatus in accordance with any one of claims 1 through 6, wherein said first torque restriction control module controls said motor to have a
20 torque variation in a preset allowable range.

 8. A motor control apparatus that controls a motor, which is mounted on a vehicle and outputs power to a drive

shaft linked to drive wheels, said motor control apparatus comprising:

a skid detection module that detects occurrence of a skid due to wheelspin of the drive wheels;

5 a torque restriction rate setting module that, in response to detection of the occurrence of a skid by said skid detection module, sets a torque restriction rate of torque output to the drive shaft corresponding to a degree of the detected skid;

10 a torque restriction rate correction module that, when control of said motor with the set torque restriction rate makes a torque variation out of a preset allowable range, corrects the torque restriction rate to limit the torque variation in the preset allowable range; and

15 a torque restriction control module that controls said motor, based on a power demand to the drive shaft and the set or corrected torque restriction rate.

9. A motor control apparatus in accordance with claim 20 8, said motor control apparatus further comprising:

an angular acceleration measurement module that measures an angular acceleration of either the drive shaft or a rotating shaft of said motor,

wherein said skid detection module detects the occurrence of a skid when the measured angular acceleration exceeds a predetermined threshold value, and

in response to detection of the occurrence of a skid
5 by said skid detection module, said torque restriction rate setting module sets the torque restriction rate of torque output to the drive shaft corresponding to the angular acceleration measured by said angular acceleration measurement module.

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10. A motor control apparatus in accordance with claim 9, wherein said torque restriction rate setting module increases the torque restriction rate with an increase in angular acceleration.

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11. A vehicle equipped with a motor and a motor control apparatus in accordance with any one of claims 1 through 10.

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12. A motor control method that controls a motor, which is mounted on a vehicle and outputs power to a drive shaft linked to drive wheels, said motor control method comprising the steps of:

(a) measuring an angular acceleration of either the drive shaft or a rotating shaft of said motor;

(b) detecting occurrence of a skid due to wheelspin of the drive wheels, in response to an increase in measured
5 angular acceleration over a preset value;

(c) in response to detection of the occurrence of a skid, setting a certain torque restriction rate to restrict an output torque level for reduction of the skid and controlling said motor with the restricted output
10 torque level; and

(d) restoring the output torque level restricted in said step (c) and controlling said motor with the restored output torque level at a predetermined timing when the angular acceleration measured in said step (a) has an
15 increase in the course of convergence of the skid by the restriction of the output torque level.

13. A motor control method in accordance with claim 12, wherein the predetermined timing represents a change
20 timing of the measured angular acceleration from negative to positive.

14. A motor control method in accordance with either

one of claims 12 and 13, wherein said step (d) controls said motor with a lower torque restriction rate than the certain torque restriction rate set by said step (c) for a preset time period, so as to restore the restricted
5 output torque level.

15. A motor control method in accordance with any one of claims 12 through 14, said motor control method further comprising the step of:

10 (e) controlling said motor with setting of a specified torque restriction, when an absolute value of a first negative peak of the measured angular acceleration detected after the increase over the preset value is greater than a predetermined threshold value.

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16. A motor control method in accordance with claim 15, wherein said step (e) controls said motor with a torque restriction rate set corresponding to the absolute value of the first negative peak as the specified torque
20 restriction.

17. A motor control method in accordance with either one of claims 15 and 16, wherein said step (e) controls

said motor with the setting of the specified torque restriction for a predetermined time period.

18. A motor control method that controls a motor,
5 which is mounted on a vehicle and outputs power to a drive shaft linked to drive wheels, said motor control method comprising the steps of:

(a) detecting occurrence of a skid due to wheelspin of the drive wheels;

10 (b) in response to detection of the occurrence of a skid by said step (a), setting a torque restriction rate of torque output to the drive shaft corresponding to a degree of the detected skid;

(c) when control of said motor with the set torque
15 restriction rate makes a torque variation out of a preset allowable range, correcting the torque restriction rate to limit the torque variation in the preset allowable range; and

(d) controlling said motor, based on a power demand
20 to the drive shaft and the set or corrected torque restriction rate.

19. A motor control method in accordance with claim

18, said motor control method further comprising the step
of:

(e) measuring an angular acceleration of either the
drive shaft or a rotating shaft of said motor, prior to

5 said step (a)

wherein said step (a) detects the occurrence of a
skid when the angular acceleration measured by said step
(e) exceeds a predetermined threshold value, and

in response to detection of the occurrence of a skid
10 by said step (a), said step (b) sets the torque restriction
rate of torque output to the drive shaft corresponding to
the angular acceleration measured by said step (e).

20. A motor control method in accordance with claim
15 19, wherein said step (b) increases the torque restriction
rate with an increase in angular acceleration.